4.0 REMEDIAL ACTION OBJECTIVES

4.1 Introduction

The purpose of the OU-2 FS is to develop and evaluate potential remedial alternatives for the source areas to enable selection of an overall remedy that will 1) be protective of human health and the environment; and 2) facilitate the OU-1 remedial goal of aquifer restoration. Based on these overall remedial goals of protectiveness and aquifer restoration, site-specific Remedial Action Objectives (RAOs) were established for OU-2 to aid in the development and screening of potential remedial alternatives. These RAOs describe what the potential remedial alternatives (and ultimately, the selected remedy) need to accomplish in order to be protective of human health and the environment and facilitate aquifer restoration.

The development of RAOs for OU-2 is carried out in a step-wise manner. First, Federal and State environmental regulations which may be relevant to the potential remedial alternatives are identified (Section 4.2). Then, RAOs are developed, based on protection of human health and the environment, which includes consideration of aquifer restoration goals (Section 4.3). The development of RAOs for OU-2 considers the 1) current and future land use at the Facility; 2) the results of the OU-2 risk assessments; and 3) fate and transport of contaminants from the source areas to groundwater. The RAOs and Federal and State regulatory requirements form the basis for development of Preliminary Remediation Goals (PRGs), or cleanup criteria for the source areas.

4.2 Identification of Site-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Requirements

According to the Comprehensive Environmental Response and Cleanup Liability Act (CERCLA), one of the requirements of the FS process is to identify the Federal and State environmental regulations associated with the remedial alternatives being considered. Specifically, Section 121(d) of CERCLA and the National Oil and Hazardous Substances Contingency Plan (NCP), require that the selected remedial action for a site meet the following requirements:

1. The remedial action must be protective of human health and the environment.
2. The remedial action must comply with all Federal and State Applicable or Relevant and Appropriate Requirements (ARARs), if they exist, unless grounds for invoking a waiver of ARARs are provided. These ARARs are used in combination with the RAOs to assess remedial alternatives for the site.

These requirements make certain that remedial actions performed under CERCLA comply with all pertinent Federal and (New Jersey) State environmental requirements. These requirements, which place controls on remedial actions to ensure protection of human health and the environment, as well as ensuring proper management of remediation waste, are discussed below.

4.2.1 DEFINITION OF ARARS AND TBCS

EPA, in conjunction with the State agencies (such as NJDEP), is required under CERCLA to identify promulgated standards, requirements, criteria, or limitations that will be met during the implementation of the remedy. The identified promulgated standards, requirements, criteria, or limitations are called ARARs. As defined in the NCP, an ARAR may be either 1) an applicable requirement or 2) a relevant and appropriate requirement, as follows:

Applicable Requirements are "those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site."

Relevant and Appropriate Requirements are "those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site."

Under the NCP, remedial actions must comply with State ARARs that are more stringent than Federal ARARs. State ARARs are also used in the absence of a Federal ARAR, or where a State ARAR is broader in scope that the Federal ARAR. In order to qualify as an ARAR, State requirements must be promulgated and identified in a timely manner. Furthermore, for a State requirement to be a potential ARAR it must be applicable to all remedial situations described in the requirement, not just at CERCLA sites.

4.2.1.1 Types of ARARs

There are three (3) broad categories of ARARs, based on the manner in which they are applied at a site. These categories are as follows:

- **Chemical-Specific ARARs** define acceptable exposure levels for a specific chemical in an environmental medium and are used in establishing preliminary remediation goals (PRGs). They may be actual concentration based clean-up levels, or they may provide the basis for calculating such levels. Examples of chemical-specific ARARs are Maximum Contaminant Levels (MCLs) in drinking water or ambient air quality standards.

- **Location-Specific ARARs** are restrictions imposed when remedial activities are performed in an environmentally sensitive area or special location, such as wetlands or floodplains.

- **Action-Specific ARARs** set controls or restrictions on specific treatment or disposal technologies, such as management of post-excavation remediation waste.

The different categories of ARARs are considered at various stages of the FS process. For example, chemical-specific ARARs are considered early in the FS process and are used to develop preliminary remediation goals (PRGs) or cleanup standards for the media of concern. The applicability of surface and subsurface PRGs for OU-2 is discussed in Section 4.4. The development of subsurface PRGs is based on OU-1 aquifer restoration goals, as described in Section 6.0.

Location-specific and action-specific ARARs are typically considered during the evaluation of potential remedial alternatives and selection of the preferred remedy. These ARARs are addressed during remedial design of the preferred remedy.

ARARs are not currently available for every chemical, location or action that may be encountered. For example, there are currently no ARARs that specify clean-up levels for soils and, with certain exceptions, waste. In this case, EPA and State agencies may identify non-promulgated advisories, criteria or guidance documents to supplement an ARAR provision or to apply in cases where ARARs are not currently available. The resulting requirements derived from these regulatory sources are referred to as "To Be Considered Requirements" or TBCs. TBCs are not legally binding and do not have the same status as potential ARARs. However, TBCs can be used to determine the necessary level of cleanup for the protection of human health and the environment.

4.2.2 IDENTIFICATION OF ARARS AND TBCS FOR OU-2

The section presents a summary of the ARARs and TBCs identification process for OU-2, which resulted in a list of ARARs and TBCs that could be invoked for the potential remedial alternatives for the source areas. Table 4-1 presents the relevant ARARs and TBCs based on evaluation of the following statutory divisions:

- Clean Air Act;

- Comprehensive Environmental Response, Compensation, and Liability Act;
- Federal Water Pollution Control Act;
- Hazardous Materials Transportation Act;
- Natural Resource and Wildlife Protection Laws;
- Occupational Safety and Health Act;
- Safe Drinking Water Act;
- Solid Waste Disposal Act; and
- Toxic Substances Control Act.

As shown on Table 4-1, the potential ARARs and TBCs (both Federal and corresponding State regulations) are subdivided by the Federal statutory division of the regulation. This subdivision was chosen rather than dividing the ARARs and TBCs into chemical-, location-, and action-specific categories, since the statutory division is better suited to identify and discuss overall issues associated with applying the statutory requirements to the OU-2 remediation. A detailed discussion of the statutes and their associated requirements is provided in Appendix B of the FS report. It should be noted that for the Hazardous Material Transportation Act, the Toxic Substance Control Act and the Occupational Safety and Health Act, no ARARs or TBCs were identified for the OU-2 remediation. The basis for this determination is provided in Appendix B.

Based on evaluation of the Federal and State statutes and the associated requirements which are pertinent the OU-2 remediation, the following points are noteworthy:

1. Both Federal and State authorities have attempted to develop both a framework and specific values for clean-up criteria in soils and waste. These initiatives have included the EPA Office of Solid Waste and Emergency Response (OSWER) Soil Screening Levels and NJDEP's proposed soil cleanup standards under the Industrial Site Recovery Act. However, none of these initiatives have been promulgated. A summary of these various initiatives is provided in Appendix B. The result is that there are currently no applicable, relevant or appropriate standards for soils, and with certain exceptions, wastes. Rather, clean-up goals for OU-2 are based on risk-based preliminary remediation goals (PRGs), as discussed in Section 4.3.

2. The majority of ARARs and TBCs determined to be relevant for the OU-2 remediation are action-specific ARARs, particularly under the RCRA statute. These ARARs relate to potential remedial alternatives that involve removal and treatment, storage and/or disposal of hazardous waste material. The specific requirements invoked by these ARARs such as 1) land disposal requirements (LDRs) and associated treatment standards and 2) the applicability of Corrective Action Management Units (CAMUs), is discussed in the detailed analysis of remedial alternatives which involve removal and treatment and/or disposal activities.

During the detailed analysis of remedial alternatives (Section 9.0 of the FS Report), potential remedial alternatives will be assessed to determine which ARARs pertain to the specific alternative. Section 121 of SARA requires that the remedy chosen for a CERCLA site must attain all ARARs, unless there is sufficient grounds to invoke an ARAR waiver. These waivers are described in the next Section.

4.2.3 ARAR WAIVERS

If an ARAR can not be attained, EPA can still select a remedial alternative as the preferred remedy if there are sufficient grounds to invoke one of the six waivers listed below.

1. ***Interim Measures Waiver.*** This waiver may be obtained when the selected remedial action is an interim remedy or a portion of a total remedy that will attain the standard upon completion.

2. ***Greater Risk to Human Health and the Environment Waiver.*** This waiver may be invoked for an ARAR that can only be met by implementing a remedial action that poses greater risk to human health and the environment than non-compliance with that ARAR.

3. ***Technical Impracticability Waiver.*** This waiver would apply when compliance with a requirement is technically impracticable from an engineering perspective.

4. ***Equivalent Standard of Performance Waiver.*** This waiver may be used when in cases where an ARAR stipulates use of a particular design or operating standard, but equal or better remedial results could be achieved using a different design or method of operation.

5. ***Inconsistent Application of State Requirements Waiver.*** This waiver may be used when the requirement has been promulgated by the State, but has not 1) been consistently applied in similar circumstances; or 2) has never applied in past situations.

6. ***Fund-Balancing Waiver.*** This waiver may be invoked when compliance with the ARAR would not provide a balance between protecting public health and the environment at the specific site and the availability of Superfund Program funds for response at other sites.

Further details on these ARAR waivers, including the circumstances under which each waiver might be invoked and the criteria for invoking the waiver, are provided in Appendix B.

Table 4-1

SUMMARY OF RELEVANT ARARs AND TBCs

CLEAN AIR ACT

Citation	Regulation	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	Establishes primary and secondary NAAQS under Section 109	X		X		Chemical
40 CFR 52	New Source Review (NSR) and Prevention of Significant Deterioration (PSD) Requirements	Defines the emissions and ambient impact thresholds for requirements under NSR and PSD	X	X			Action
40 CFR 60	New Source Performance Standards (NSPS)	Establishes testing, control, monitoring and reporting requirements for new sources	X		X		Action
40 CFR 61 40 CFR 63	National Emission Standards for Hazardous Air Pollutants (NESHAP), Title III of 1990 CAA Amendments	Establishes emission standards for hazardous air pollutants	X		X		Action
NJAC 7:27-16	Release of Volatile Organic Compounds (VOCs)	Establishes allowable VOC emission rates for certain remedial actions	X	X			Action

CLEAN AIR ACT (continued)

Citation	Regulation	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
NJAC 27:17	Release of Toxic Substances	Regulates atmospheric discharge of listed toxic volatile organic substances	X	X			Action
NJAC 7:27-4	Particle Emissions From Fuel Burning	Regulates industrial fuel-burning equipment which may release smoke or airborne particulates	X	X			Action
NJAC 7:27-11	Emissions from Incinerators	Establishes particulate emission limits for incinerators	X		X		Action

CLEAN WATER ACT

Citation	Regulation	Description	ARAR	Applicable	Relevant And Appropriate	TBC	Type Of ARAR/TBC
33 USC Section 1344 33 CFR 323 33 CFR 320-330 40 CFR 6 (App. A)	Protection of Wetlands and Floodplains	Applies to remedial facilities located in wetlands or floodplains	X	X			Location
40 CFR 122, Subpart B 40 CFR 136	National Pollutant Discharge Elimination System (NPDES) Program Requirements	Establishes permitting requirements for point source discharges	X	X			Action
Ch. 251 Public law T975	NJ Soil Erosion and Sediment Control Act	Establishes permitting requirements for soil erosion control	X	X			Action

SAFE DRINKING WATER ACT

Citation	Regulation	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
40 CFR 141 (Subparts B, F and G) 40 CFR 142	National Primary Drinking Water Standards	Establishes maximum contaminant levels (MCLs) for public water systems	X		X		Chemical
40 CFR 143	National Secondary Drinking Water Standards	Establishes secondary standards (related to aesthetic qualities) for public water systems				X	Chemical

RESOURCE CONSERVATION AND RECOVERY ACT

Citation	Requirements	Description	ARAR	Applicable	Relevant And Appropriate	TBC	Type Of ARAR/TBC
RCRA Subtitle C 40 CFR 264.94	Standards for Owners/Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF), Groundwater Protection Standards	Establishes concentration limits for hazardous constituents in the uppermost groundwater unit at regulated solid waste units	X	X			Chemical
RCRA Subtitle C 40 CFR 264.18	Siting of Hazardous Waste Facilities	Provides siting requirements for hazardous waste facilities within floodplain area	X	X			Location
RCRA Subtitle C 40 CFR 262.11	Standards Applicable to Generators of Hazardous Waste, Hazardous Waste Determination	Requires generator to characterize all solid waste	X	X			Action
RCRA Subtitle C 40 CFR 262, Subparts B, C and D	Standards Applicable to Generators of Hazardous Waste, Manifesting, Pre-Transportation Record Keeping and Reporting Requirements	Requirements regarding waste packaging and labeling, manifests, record keeping and reporting	X	X			Action

RESOURCE CONSERVATION AND RECOVERY ACT (continued)

Citation	Regulation	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
RCRA Subtitle C 40 CFR 264/265, Subpart B	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facility (TSDF), General Facility Standards	Outlines the general requirements for owners/operators of a hazardous waste TSDF	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart C and D	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF), Preparedness/Prevention and Contingency Plan/Emergency Procedures	Outlines requirements for contingency plan and emergency procedures	X	X			Action
RCRA Subtitle C 40 CFR 264, Subpart F	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF), Releases from Solid Waste Management Units (SWMUs)	Establishes detection, compliance and corrective action monitoring program to ensure protection of groundwater	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart G	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF), Closure and Post-Closure	Establishes closure requirements for permitted TSDF	X	X			Action

RESOURCE CONSERVATION AND RECOVERY ACT (continued)

Citation	Requirements	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
RCRA Subtitle C 40 CFR 264/265, Subpart I	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF), Use and Management of Containers	Requires all hazardous waste to be stored and managed in appropriate containers	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart J	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Tank Systems	Requirements which apply to hazardous waste stored in tanks	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart K	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Landfills	Establishes closure requirements for landfills	X	X			Action
RCRA Subtitle C 40 CFR 264.552 40 CFR 264.553, Subpart S	Standards for Owners/Operators of Hazardous Water Treatment, Storage and Disposal Facilities, Corrective Action for Solid Waste Management Units (CAMUs)	Establishes requirements for managing hazardous waste in a CAMU	X		X		Action

RESOURCE CONSERVATION AND RECOVERY ACT (continued)

Citation	Requirements	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
RCRA Subtitle C 40 CFR 264, Subpart X	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Miscellaneous Units	Provides construction and operation requirements for miscellaneous hazardous waste management units	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart AA	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Air Emission Standards for Process Vents	Establishes standards for process vents associated with hazardous waste management	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart BB	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Air Emission Standards for Equipment Leaks	Establishes requirements for process equipment in contact with hazardous waste	X	X			Action
RCRA Subtitle C 40 CFR 264/265, Subpart DD	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Containment Buildings	Establishes requirements for hazardous waste treated or stored in a containment building	X	X			Action

RESOURCE CONSERVATION AND RECOVERY ACT (continued)

Citation	Requirements	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
RCRA Subtitle C 40 CFR 265.228	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Surface Impoundment's	Establishes closure requirements for surface impoundments	X	X			Action
RCRA Subtitle C 40 CFR 268, Subparts A to D	Land Disposal Treatment Standards	Establishes treatment standards for placement of hazardous waste in a land disposal unit	X	X			Action
RCRA Subtitle C 40 CFR 268, Subpart E	Prohibition on Storage of Restricted Waste	Requirements which limit the timeframe for storage of hazardous waste	X	X			Action
RCRA Subtitle D 40CFR 257.3-1 40 CFR 258.10-15	Siting of Solid Waste Disposal Facilities	Regulates solid waste facilities in floodplain areas	X	X			Location
RCRA Subtitle D 40 CFR 257	Criteria for Classification of Solid Waste Disposal Facilities and Practices	Specifies location, design and operational requirements for solid waste facilities	X	X			Action

RESOURCE CONSERVATION AND RECOVERY ACT (continued)

Citation	Requirements	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
RCRA Subtitle I 40 CFR 280	Underground Storage Tank (UST)Requirements	Establishes requirements for design, construction and operation of USTs	X	X			Action

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

Citation	Regulation	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
NJSA 13:1 K-6 et. Seq.	Environmental Contamination and Responsibility Act (ECRA) Industrial Site Recovery Act (ISRA)	Establishes requirements for cleanup of real property at the time of transfer				X	Chemical

NATURAL AND CULTURAL RESOURCE PROTECTION LAWS

Citation	Regulation	Description	ARAR	Applicable	Relevant and Appropriate	TBC	Type Of ARAR/TBC
500 CFR 200 50 CFR 402	Endangered or Threatened Species or Critical Habitat Preservation	Requires mitigation measures if remedial action affects identified threatened or endangered species or its critical habitat	X	X			Location
16 USC Sec. 1451 et. seq.; 16 USC Section 3501 et. Seq.	Coastal Zone Protection	Requires compliance with State coastal zone management program	X	X			Location

4.3 LAND USE

Land use assumptions are an integral factor in the development of Remedial Action Objectives. These assumptions affect the exposure pathways that are evaluated and future land use is important in estimating potential future exposure and associated risks, if any. Realistic land use assumptions allow the FS to be focused on developing practicable and cost effective remedial alternatives.

EPA's directive on land use in the CERCLA remedy selection process (EPA 1995b) supports the formulation of realistic assumptions regarding future land use and clarifies how these assumptions influence the development of alternatives and the process of remedy selection. The key points of this directive which are relevant to the FS process are the following:

1. Remedial action objectives should reflect the reasonably anticipated future land use or uses.

2. Future land use assumptions allow the baseline risk assessment and the feasibility study to be focused on developing practicable and cost effective remedial alternatives. These alternatives should lead to site activities that are consistent with the reasonably anticipated future land use.

3. Land uses that will be available following completion of remedial action are determined as part of the FS process. During this process, the goal of realizing reasonably anticipated future land uses is considered along with other factors. Any combination of unrestricted uses, restricted uses, or use for long term waste management may result.

Consistent with the EPA guidance, an assessment of current and future land uses for the Facility was conducted, which considered the following factors:

1. Current site conditions, such as acreage, zoning and current land use, including the OU-1 remediation activities;

2. The zoning and character of the surrounding neighborhood; and

3. Potential future land uses for the Facility, including residential, recreational, conservation, commercial and industrial.

The intent of this land use evaluation is to ascertain feasible options for the development of the Facility as it pertains to the OU-2 FS.

4.3.1 SITE CONDITIONS

As discussed previously, the Facility is comprised of approximately 1,350 acres. Of this total, 72 acres are in Manchester Township and are zoned "Residential"; 39 acres are in Dover Township, east of Oak Ridge Parkway (physically separate from the main plant Facility) and are zoned "Conservation-Residential"; and the remaining 1,240 acres constitute Dover Township's largest single tract of industrially zoned land (see Figure 4-1). One other property owned by Ciba in Dover Township, which consists of approximately one acre of industrial land (which is contiguous to the main plant site), is currently subject to a 99-year lease with the Dover Township Volunteer Fire Department for use as a fire station.

Over the years, approximately 320 acres of the 1,240 acres of industrial land was developed for manufacturing operations, waste treatment and disposal activities. The other acreage remains undeveloped.

4.3.2 NEIGHBORHOOD CHARACTERISTICS

As shown on Figure 4-1, the Facility is bordered on the north by the Pine Lake Estates residential neighborhood of Manchester Township, a densely populated lakeside community of single family homes. Other than this northern boundary, all other borders are in Dover Township. On the northeast, the Facility is bordered by the Toms River and by undeveloped land, zoned "Conservation-Residential" (R-400C). While this area is zoned for residential use, it is unlikely that any future construction will occur due to the land's proximity to the banks and floodplain of the Toms River. On the east, Winding River Park borders the Facility, which is also located in the R-400C zone. The 480-acre Winding River Park is Dover Township's largest town owned and operated recreational facility.

Adjacent to the southern border of the Facility are two different zones, R-90 and RHB ("Rural Highway Business," a commercial zone), along Route 37. The RHB zone allows a wide variety of retail and wholesale shops, service establishments and office space. On the southeast, the Facility is bordered by the Oak Ridge residential (R-90 zone) subdivision, which contains approximately 500 single-family homes. This zone allows the same types of development as R-400C, except that the minimum lot size is smaller. Finally, the Facility is bordered on the west and southwest by the Toms River Industrial Park, a 150-acre parcel established by Dover Township for industrial development. The town's industrial zone allows a variety of manufacturing, fabrication and other industrially related operations. Several industrial operations are active in this park.

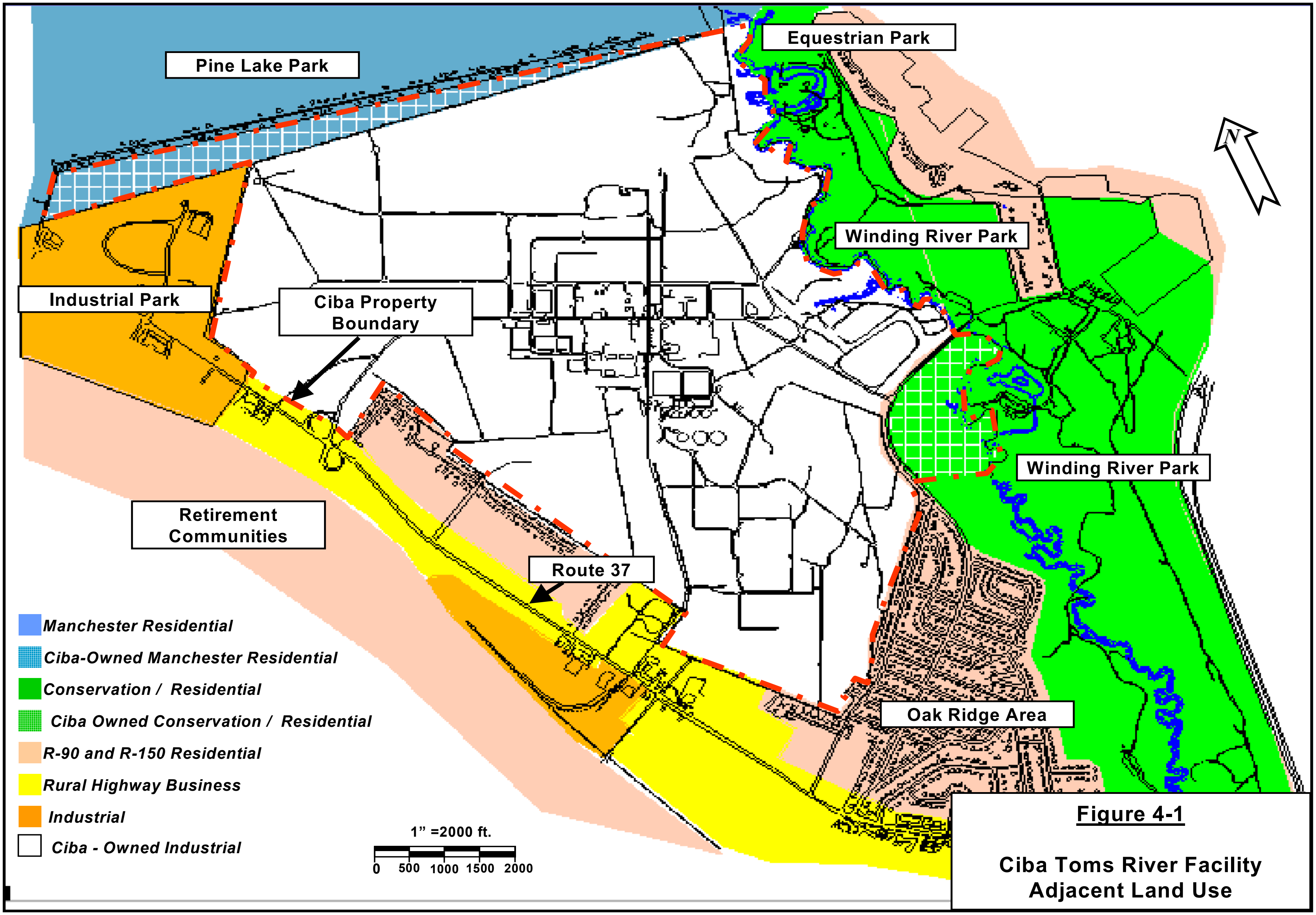


Figure 4-1

Ciba Toms River Facility Adjacent Land Use

4.3.3 POTENTIAL FUTURE LAND USES

Figure 4-2 depicts a preliminary future land use plan for the Facility based on evaluation of the current site conditions and surrounding neighborhood:

1. The undeveloped portion of the Facility is considered available for unrestricted use. This is dependent on meeting all regulatory requirements as the need arises.
2. The developed portion of the Site will be a commercial/industrial/recreational use area.
3. The active waste management area, which includes the wastewater treatment facility to the Active Landfill, is considered a restricted waste management area with no future development planned.

This conceptual plan will be considered when defining remedial action objectives and evaluating remedial alternatives, as appropriate.

4.4 Protection of Human Health and the Environment

4.4.1 INTRODUCTION

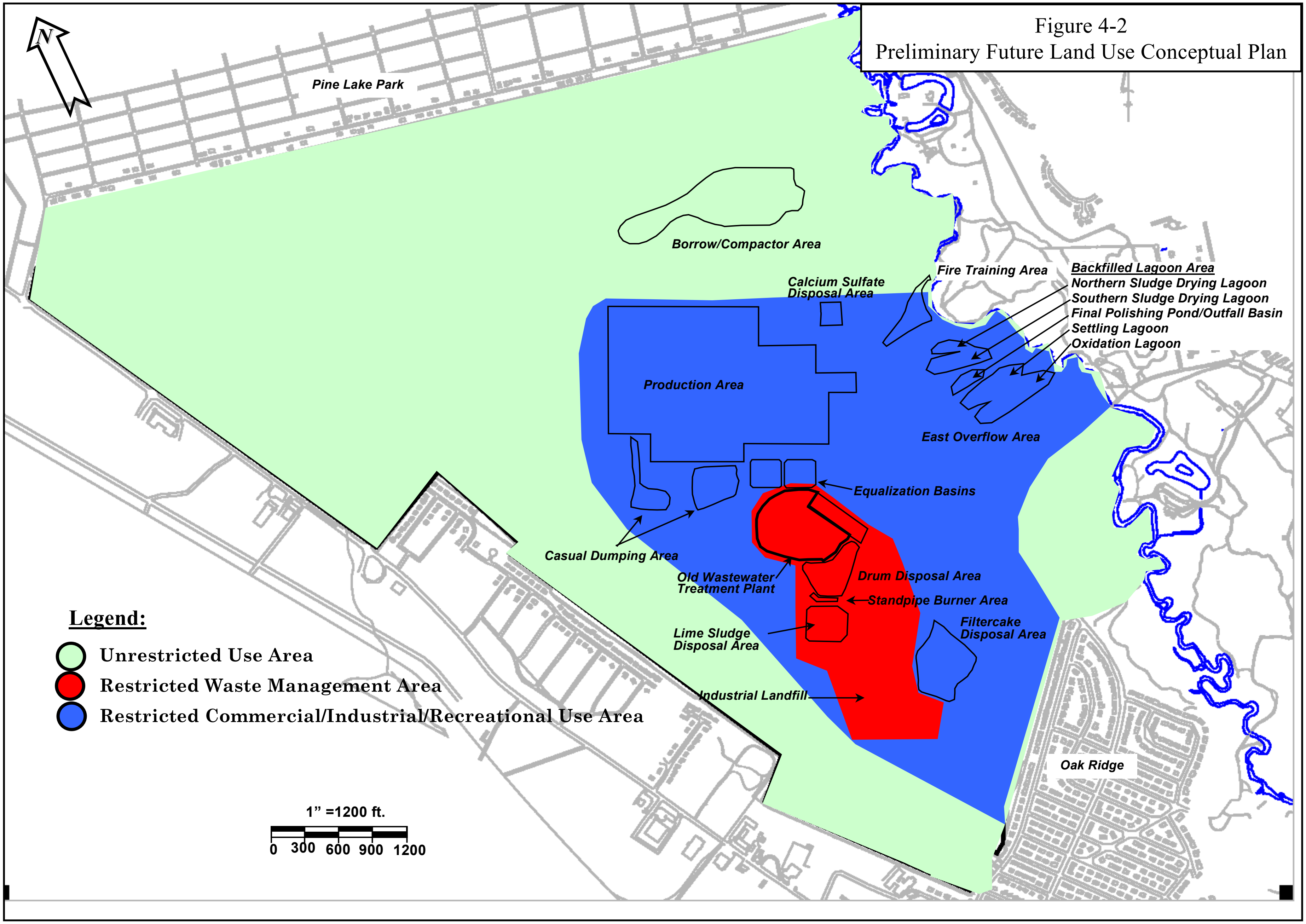
According to EPA guidance (EPA 1988), RAOs consist of medium-specific or operable unit-specific goals for protecting human health and the environment and typically specify the following:

- Relevant exposure scenarios, which describe the environmental media and chemicals of potential concern, the potential exposure routes and receptors, and the potential exposure pathways to be addressed by remedial actions; and
- Acceptable contaminant concentration levels or rates of release for each environmental medium and exposure route of concern. These "clean-up standards" are called Preliminary Remediation Goals (PRGs).

Based on the data presented in the Source Control RI Report (CDM 1994a), the following exposure scenarios related to OU-2 may impact human health and the environment:

- Potential direct contact exposure to contaminated surface water, sediments and air associated with the Marshland Area;
- Potential direct contact exposure to contamination in source areas surface soils; and
- Continued migration of contaminants in source areas subsurface media (soils and waste material) will prolong the timeframe for the OU-1 remedy to remediate contaminated groundwater in the upper aquifer.

Figure 4-2
Preliminary Future Land Use Conceptual Plan



According to EPA guidance (EPA 1988), once the relevant exposure scenarios have been identified, preliminary remediation goals (PRGs) are defined, which establish acceptable exposure levels that are protective of human health and the environment. PRGs based on protection of human health are generally expressed in terms of both a contaminant level and an exposure route. This is the case because protectiveness may be achieved by eliminating exposure (i.e., capping an area, limiting access or providing an alternate water supply) as well as by reducing contaminant concentration levels. PRGs addressing environmental protection are typically based on preservation or restoration of a resource (i.e., groundwater), and are usually expressed in terms of the medium of interest and target cleanup levels.

There are two major sources of numerical PRGs, namely 1) Federal and State legally enforceable cleanup standards (chemical-specific ARARs); and 2) risk-based concentrations that are determined to be protective of human health and the environment. PRGs are typically based on ARARs if they are available and considered protective. However, as discussed in Section 4.2, chemical-specific ARARs (clean-up standards) do not exist for all chemicals and environmental media. If cases where ARARs are not available, risk-based PRGs are calculated based on site-specific data using EPA risk assessment methodology.

PRGs are a fundamental component of the OU-2 FS process because they provide quantitative targets for prioritizing the source areas and assessing the effectiveness of remedial alternatives. The main criteria for establishing OU-2 PRGs is based on 1) addressing direct contact exposure to the contaminated source area media; and 2) assessing the impact of the source areas upon groundwater quality (i.e., the OU-1 aquifer restoration goals). Use of these criteria will facilitate the understanding of the overall significance of source areas and the need for remedial action.

4.4.2 RISK ASSESSMENTS

This section presents the results of EPA risk assessments for the surface soils and Marshland Area. These assessments quantified the potential risk to human health and the environment if direct contact exposure to contaminated media in the Marshland Area or the source area surface soils were to occur.

4.4.3 MARSHLAND AREA

4.4.3.1.1 Background

The Marshland Area consists of two subareas within the wetlands along the Toms River. The "Northern Marshland Area" is located on the eastern side of the river opposite the Fire Prevention Training Area. The "Southern Marshland Area" is located northeast of Sun Valley Road and the Cardinal Drive residential areas. These areas are separated by approximately one (1) river mile (see Figure 4-3).

As reported in the Source Control RI Report (CDM 1994a), there is no evidence that chemical wastes were disposed in the Marshland Area and consequently, the Marshland Area is not considered a primary source area at the Ciba site. However, previous investigations have determined that groundwater leaving the Site discharges to the Marshland Area. In the past, these discharges resulted in elevated concentrations of site-related organic and inorganic contaminants. Most of the detections occurred in the sediment at the Southern Marshland Area.

In 1991 and 1992, concurrent with the Source Control RI sampling, a baseline monitoring study of the Toms River and wetlands in the vicinity of the Site was conducted by EPA's contractor, CDM. The implementation of the OU-1 groundwater extraction system; and 2) assess the current impact of the contaminated groundwater on river water quality. As part of the baseline monitoring, CDM conducted supplemental sampling of wetlands sediments in areas of known discharge of contaminated groundwater (i.e., the Northern and Southern Marshland Areas). The results of the baseline monitoring, as well as a summary of previous investigations of the Toms River and adjacent wetlands, can be found in the final Baseline Characterization of the Toms River and Wetlands Report (CDM 1994b). The results of this report are summarized below.

Utilizing the analytical data collected from the baseline monitoring of the Toms River and wetlands (CDM 1994a), CDM performed a wetlands functional assessment and an ecological assessment of the potential risks to aquatic biota in the Toms River and adjacent wetlands due to chemicals present in these areas. The results of these assessments, which are discussed below, are provided in the Wetlands Characterization and Ecological Assessment Report (CDM 1994c).

The following discussion summarizes the data and conclusions of the Source Control RI Report (CDM 1994a), the baseline characterization of the Toms River and wetlands (CDM 1994b) and the wetlands

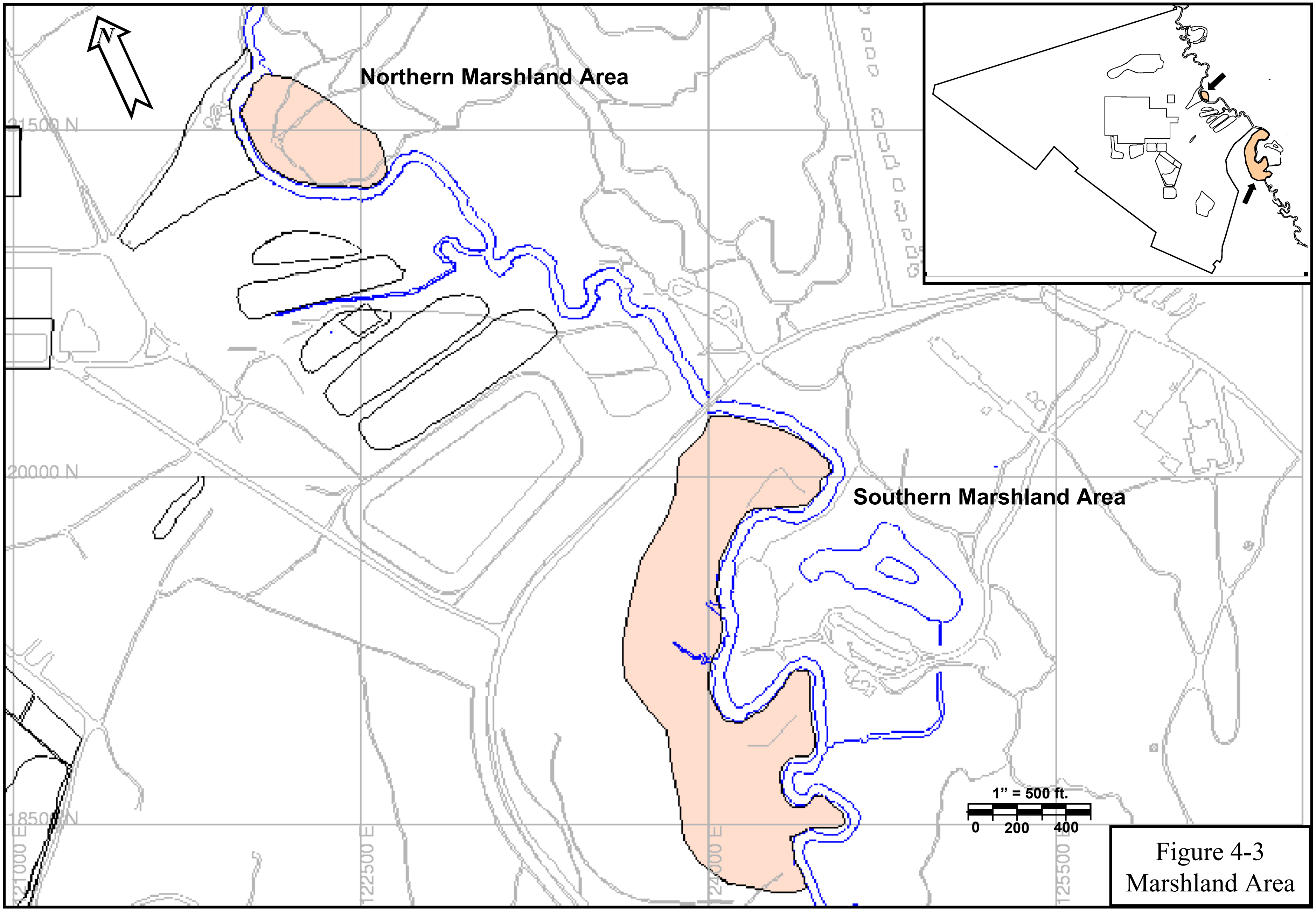


Figure 4-3
Marshland Area

functional assessment and ecological risk assessment for the Site (CDM 1994c). These documents form the basis for evaluating potential risks to human health and the environment associated with the Marshland Area.

4.4.3.1.2 Exposure Characterization

Aquatic flora and fauna are the most likely ecological receptors to be exposed to chemicals in the surface water and sediment of the marshland and river. Exposure could occur through respiration, direct contact, or incidental ingestion while foraging. Bioaccumulation is not an important issue given that most of the chemicals detected in the marshland do not significantly accumulate in aquatic life and that EPA reported no accumulation of site-associated chemicals in its *in situ* exposure studies (i.e., fish bioaccumulation study) (CDM 1994c).

Exposure to receptors in the Marshland Area would likely be greatest at the point where groundwater discharges to the surface. Receptors in the Toms River could be exposed if chemicals are transported from the Marshland Area to the river.

Since the OU-1 groundwater extraction system prevents future discharge of contaminated groundwater to the Marshland Area, data from previous studies will overestimate current and potential future exposures. Nevertheless, these baseline data can be used to provide a “worst-case” estimate of conditions in the Marshland Area and adjacent Toms River under current and potential future conditions.

During the Source Control RI, volatile organic chemicals (VOCs) and semivolatile organic chemicals (SVOCs) were detected in Marshland Area sediments, surface waters and air. In general, concentrations were greatest in sediments; concentrations in water and air were up to several orders of magnitude less than concentrations in sediments. For example, concentrations of total VOCs ranged from 0.069 to 32 parts per million (ppm) in sediments, but were 0.036 to 0.369 ppm in surface waters and were 0.002 to 0.381 ppm by volume in air. (It should be noted that all the air results were reported as estimated values. The highest air result is inconsistent with all previous sampling events and appears to be a sample anomaly). Concentrations of total SVOCs ranged from 0.093 to 6.0 ppm in sediments, and were 0.005 to 0.024 ppm in surface waters; air was not sampled for semivolatiles (CDM 1994a). In general, metals were found to be within the range of concentrations typical for local or regional background conditions. Current and future concentrations are likely to be lower, as noted above, due to implementation of the OU-1 groundwater extraction system.

Based on the baseline data, the Marshland Area does not appear to act as a secondary source of contaminants to receptors in the Toms River. The results of sediment fate and transport modeling conducted for the Site indicated that even worst-case conditions (e.g., using maximum concentrations, no dilution, and historic low-flow) predicted low contaminant concentrations in waters and sediments of the Toms River (CDM 1994c). These predictions were confirmed by sample analyses conducted during the baseline study, which indicated that substantially fewer chemicals were present in the river water and sediments than in the Marshland Area water and sediments (CDM 1994b). Chemicals that were found were detected at lower frequencies and concentrations. Organic constituents (VOCs and SVOCs) in river surface water samples were generally in the low parts per billion (ppb) range, while inorganic analyte levels ranged from the low ppb to low ppm. Similarly, organics levels were in the low ppb range in river sediments while inorganics were generally in the low ppb to low ppm range in river sediments (CDM 1994b). CDM concluded in its baseline report that the quality of river water in the study area was comparable to that of the upstream reference stations (CDM 1994b). It should be noted that under the current OU-1 long-term monitoring plan, organic constituents were detected at sub ppb levels (less than 1 ppb) in surface water samples collected from the Toms River in 1998 (Ciba 1999b).

4.4.3.1.3 Effects Characterization

Solid-phase sediment toxicity tests (10-day exposures) were conducted using the amphipod *Hyalella azteca* to investigate the possibility that chemicals detected in the Marshland Area could exert a toxic effect on sensitive marshland receptors (CDM 1994b). Results indicate that sediments taken from the marshland locations exerted adverse effects on test organism survival in the laboratory, but that these effects were not necessarily due to chemicals in marshland sediments. Instead, the adverse effects were determined to be due to pH differences (unrelated to the site) in the Marshland Area samples (CDM 1994b).

No identifiable effects on biota were observed in the waters of Toms River. A series of site-specific ecological investigations, including macroinvertebrate surveys, fish bioaccumulation studies, and sediment bioassays, were reported in the wetland characterization and environmental assessment report (CDM 1994c). No impairment of the macroinvertebrate communities could be attributed to chemicals from the site. In addition, the presence of specific macroinvertebrate taxa that are highly sensitive to pollution (e.g., *Ephemeroptera*, *Plecoptera*, and *Trichoptera*) provides evidence of the generally good water quality of the Toms River. Furthermore, tissue analysis of caged brown bullhead and brook trout exposed to Toms River waters for 14 days indicated no bioaccumulation of site-related chemicals. The sediment toxicity test results indicated no adverse effects on amphipod growth or survival for the sediments collected from the Toms River.

4.4.3.1.4 Risk Characterization

The quantitative baseline public health evaluation (NUS 1988a), which was conducted as part of the initial RI/FS for the Site, concluded that marshland sediment and marshland air may result in completed exposure pathways through the ingestion, dermal contact and/or inhalation exposure routes. Based on these exposure pathways, potential health effects were quantified based on recreational use of the Marshland Area. The results indicate that the potential health risks associated with the exposure scenarios (ingestion of marshland sediments, dermal contact with marshland sediments and inhalation of marshland air) were insignificant (i.e., below EPA's risk range of 10^{-4} to 10^{-6} and hazard index of less than 1.0).

EPA also evaluated the potential risk to human health from contact with marshland sediments using the supplemental wetlands sediment sampling data collected in 1992 during the baseline characterization of the wetlands and Toms River (CDM 1994b). A conservative risk analysis was conducted which compared the highest recorded levels of contaminants in Marshland Area sediments to their respective risk-based remediation levels. EPA concluded that "the highest recorded sediment levels of contaminants in the Marshland Area were categorically and significantly below their risk-based remediation levels" (EPA 1992). EPA further concluded that based on this conservative assessment estimate of the data, human health effects resulting from casual exposure to sediments by accidental ingestion, inhalation and dermal contact were deemed negligible (EPA 1992).

In the wetland characterization and ecological risk assessment report, CDM concluded that it "found no direct evidence of toxicity from [site]-related chemicals to ecological receptors" in the marshlands (CDM 1994c). CDM further noted that "[v]isual observations of terrestrial vegetation within the wetlands indicated the presence of appropriate vegetational layers and diversity of species for the habitat type". Testing of marshland sediments did indicate toxicity to amphipods in the laboratory, but this toxicity was not believed to be related to site chemicals (CDM 1994c).

CDM employed the standard Wetland Evaluation Technique (WET) in their analysis and concluded that the marshland is typical of small eastern wetlands (CDM 1994c). It scores high ratings in its provision of physical functions such as flood flow alteration and sediment/toxicant retention. Because of its small size in comparison with the watershed, it provides only limited nutrient or organic value to aquatic species. However, it rates high for diversity, abundance, breeding, migration and wintering of avian species. Overall, the marshland continues to provide a viable and typical wetland ecosystem to the area. Therefore, it is clear that the marshlands do not constitute a significant source of chemical risk to ecological receptors.

EPA's contractor categorized the baseline condition of the Toms River as "a normal, healthy Pine Barrens stream" and concluded that "adverse impacts to river biota due to contaminants from the [site] are not evident" (CDM 1994b). Based on the results of the comprehensive wetland characterization and environmental assessment, CDM states that "[t]he overall health of biota in the Toms River study area does not appear to be in jeopardy from COCs [chemicals of concern] in sediments and surface water in the study area" (CDM 1994c). CDM further concluded that based on the suite of site-specific ecological investigations conducted, "there is no evidence of river contaminant toxicity on study area biota" (CDM 1994c).

4.4.3.1.5 Conclusions and Recommendations

The Marshland Area has been a natural discharge area for the groundwater aquifer that is currently being remediated by the OU-1 groundwater extraction, treatment and recharge system. In the past, some chemicals associated with the groundwater plume have been detected in the marshland surface water and sediments. These concentrations tended to be associated with the discrete groundwater discharge locations in the marshland. The ongoing OU-1 groundwater extraction system eliminates future discharge of chemicals to the Marshland Area.

Potential human health risk due to exposure to marshland sediments and air was insignificant based on the results of the baseline public health evaluation (NUS 1988a). Based on evaluation of the supplemental Marshland Area sediment data collected on 1992, potential human health risk was deemed negligible by EPA (EPA 1992). In addition, data collected during the baseline studies indicate that the Marshland Area is not a significant secondary source of chemicals to ecological receptors. Further, chemicals that were detected in the Marshland Area and river under baseline conditions were not associated with significant ecological risk. Ecological risks under current and future conditions are expected to be even lower given that the ongoing groundwater remediation prevents current and future site-related contamination from discharging to the Marshland Area.

Thus, there is no demonstrated need to remediate the Marshland Area. The OU-1 groundwater extraction remedy provides the best means of reducing chemical transport to the marshlands. Additionally, as required by the OU-1 ROD SOW, a wetlands operational monitoring program was developed, which includes a functional analysis of the wetlands to assess whether the groundwater extraction, treatment and recharge system is adversely impacting the wetlands (Ciba 1996a). Under this program, permanent monitoring plots have been established within the wetlands for routine monitoring of water level elevations, vegetation structure and composition, as well as groundwater quality. Therefore, no other study or action is warranted at this time.

4.4.3.2 Source Area Surface Soils

The Baseline Risk Assessment for Surface Soils (CDM 1998) was conducted by CDM, under EPA's direction, to estimate the potential risks associated with direct contact of surface soils within the source areas. This assessment provided quantitative estimates, in accordance with currently accepted guidance, of the carcinogenic risks and noncarcinogenic health hazards associated with potential exposure to chemical contaminants in surface soils (defined as the 0 to 2 foot soil interval) in the absence of any further site remediation.

4.4.3.2.1 Background

Ten (10) of the potential source areas were quantitatively evaluated for potential health threats to human receptors via the exposure routes of ingestion, dermal contact, and inhalation of surface soil. The remaining areas were not included in the assessment primarily because they were inaccessible (no exposure pathway existed) or contamination was not found (see Table 4-2). For the areas that were considered, potential receptors that were evaluated included trespassers, residents, site workers and construction workers. Exposure scenarios were developed based on both present and future land uses, as appropriate.

The chemical data used in this report were obtained during the RI field activities conducted from 1990 through 1992. Chemicals of potential concern (COCs) were selected for each of the ten source areas were quantitatively evaluated in the risk assessment. These chemicals were expected to be most representative of site conditions and were considered the greatest potential contributors to potential human health impacts. The toxicity assessment presented general toxicological properties of the COCs using toxicological human health effects data. Chemicals with insufficient toxicological data were qualitatively addressed.

During preparation of the report, EPA determined that Tentatively Identified Compounds (TICs) identified in the surface soils at the site required further evaluation. As part of this evaluation, a qualitative analysis of the TICs identified in surface soil samples was performed for the site. These compounds could not be quantitatively evaluated due to a lack of toxicological information. One hundred and forty-seven TICs were identified in the surface soil data. A screening protocol was established to develop a list of TICs for further evaluation.

4.4.3.2.2 Risk Characterization

Application of the screening protocol identified 14 surface soil TICs and toxicity profiles were developed for these chemicals. Toxicity data obtained for the 14 TICs were inadequate to develop quantitative benchmarks of toxicity in the form of cancer slope factors or reference doses. Therefore, these compounds were qualitatively evaluated and the results of this evaluation did not alter the outcome of the quantitative risk analysis. It should be noted, however, that TICs were carried through the FS process and were considered quantitatively in treatability studies as well as qualitatively in the evaluation of remedial technologies (Section 7.0).

Based on the exposure scenarios, risk and health effects were characterized by integrating the exposure and chemical toxicity assessments into quantitative expressions of risk and hazards. The carcinogenic risks and noncarcinogenic hazard indices were calculated based on a reasonable maximum exposure (RME) scenario (the highest exposure reasonably expected to occur at a site). The resulting estimates of potential human health impacts were then compared to EPA's acceptable threshold values for carcinogens and noncarcinogens (i.e., risk range of 10^{-6} to 10^{-4} and hazard index of 1.0) as defined in EPA risk assessment guidance (EPA 1989).

The results of the risk characterization identified the Filtercake Disposal Area as the only area exceeding EPA’s acceptable threshold values for carcinogens (risk range of 10^{-4} to 10^{-6}) and noncarcinogens (hazard index of 1.0) for the inhalation and ingestion routes of exposure, based on potential future residential, site worker and construction worker land use scenarios.

4.4.3.2.3 Preliminary Remediation Goals

Based on the results of the risk characterization, EPA calculated risk-based Preliminary Remediation Goals (PRGs) for the various future land use scenarios for those contaminants that exceeded EPA’s

Table 4-2

SOURCE AREAS EVALUATED IN SURFACE SOILS RISK ASSESSMENT

Source Area	Quantitatively Evaluated in Surface Soils Risk Asessment?
Calcium Sulfate Disposal Area	Yes
Lime Sludge Disposal Area	Yes
Fire Training Prevention Area	Yes
Filtercake Disposal Area	Yes
Borrow Compactor Area	Yes
Casual Dumping Area	Yes
Backfilled Lagoon Area	Yes
Drum Disposal Area	Yes
Equalization Basins	Yes
Production Area	Yes
Old Wastewater Treatment Plant/Old Oxidation Lagoon Area	No (1)
Overflow Basin Area	No (1)
Ocean Outfall Basin	No (1)
East Overflow Area	No (2)
Standpipe Burner Area	No (3)

(1) EPA could not collect surface soil samples from these source areas because they were either asphalt-covered or under water, and thus were eliminated as potential pathways of exposure.

(2) For this area the subsurface soils EPA collected did not reveal the presence of any chemical contamination and thus surface soil samples were not collected.

(3) This area was not included in this evaluation as it was identified as a potential source area subsequent to the Source Area RI (CDM 1994a). However, no direct contact exposure pathway exists (the area was capped with a soil cover and the majority of this area is currently under an asphalt road).

acceptable threshold values (risk range of 10^{-6} to 10^{-4} and/or hazard indices greater than 1.0). The PRGs for the applicable commercial/industrial use scenario (residential use is not planned) are presented in Table 4-3.

As Table 4-3 illustrates, risk-based PRGs are developed for a specific exposure pathway and land use combination. Site-specific future land assumptions are important in estimating realistic potential future exposure and associated risks. As discussed in Section 4.3, EPA guidance on land use in the FS process (EPA 1995b) supports the formulation of realistic assumptions regarding future land use. It states that remedial action objectives should reflect the reasonably anticipated future land use or uses.

Future use of the Filtercake Disposal Area will be restricted to non-residential use. The most realistic future land use is a restricted commercial/industrial use scenario involving a site worker and/or construction worker. The only future construction activities that may occur in the Filtercake Disposal Area would be related to OU-2 remediation efforts. Appropriate health and safety measures would be taken to prevent potential short-term risk to workers engaged in remedial activities.

As discussed in the detailed evaluation of remedial alternatives (Section 9.0), the alternatives that address the subsurface contamination in the Filtercake Disposal Area (based on groundwater impact) coincidentally address potential exposure to the surface soils. Components of these remedial alternatives which address potential surface soil exposure include capping of the Filtercake Disposal Area once it is remediated.

4.4.4 SOURCE AREA IMPACT ON GROUNDWATER

The OU-1 groundwater remedy has already addressed potential risk to human health and the environment from the use of contaminated groundwater. Under the current land use, no on-site groundwater receptors exist and institutional controls are in place to prevent potential exposures to contaminated groundwater under future land use scenarios. As defined in the OU-1 ROD (EPA 1994, Appendix A), groundwater will continue to be extracted and treated until the Federal and State cleanup standards (ARARs) are met to the maximum extent practicable. In the OU-1 CD (EPA 1994), the cleanup standards for aquifer restoration were provided in the OU-1 ROD (Appendix A, Tables 5 and 6) and were updated in the OU-1 ESD (Appendix D, Table 2).

TABLE 4-3

RISK-BASED PRELIMINARY REMEDIATION GOALS (PRGs) FOR COMMERCIAL/INDUSTRIAL FUTURE LAND USE

SITE WORKER

Chemical:	Risk-Based PRGs (mg/kg) Carcinogens 10^{-6}	10^{-5}	10^{-4}
Arsenic	3.3	33	330
Chromium VI	1328	12380	132800

CONSTRUCTION WORKER

Chemical:	Risk-Based PRGs (mg/kg) Carcinogens 10^{-6}	10^{-5}	10^{-4}
Arsenic	11	110	1100

Chemical:	Noncarcinogens
Arsenic	82
Mercury	82

One of the objectives of OU-2 remediation is to shorten the timeframe it takes the OU-1 groundwater remedy to clean up the aquifer (i.e., achieve the aquifer restoration goals). A primary consideration in developing OU-2 RAOs and subsurface PRGs based on the impact of the potential source areas on the OU-1 aquifer restoration goals is the nature and extent of chemical migration from the source areas. The Contaminant Transport Model (CTM) plays a critical role in the development of subsurface PRGs based on groundwater impact. It is used to define the relationship between the contaminant mass loading from the source areas and the subsequent fate and transport of the contaminants within groundwater over space and time.

The CTM is used to relate source material volumes to mass loadings from specific source areas and to ultimately link source material volumes to groundwater concentrations within the aquifer. The CTM is the tool by which OU-2 subsurface PRGs are derived based on achievement of aquifer restoration goals.

As required by the SOW, the CTM is used in the FS process to 1) evaluate the impact on aquifer restoration of each potential source area; 2) assess and prioritize each potential source area according to its present and future impact on aquifer restoration; and 3) assess, evaluate and prioritize remedial strategies for all remedial alternatives considered during the FS.

4.5 Remedial Action Objectives for OU-2

Remedial Action Objectives have been developed for OU-2 based on protection of human health and the environment. These objectives are the following:

1. Prevent/minimize potential human exposure to contaminated surface soils in the Filtercake Disposal Area.

2. Prevent/minimize the migration of subsurface contamination to the underlying aquifer. Specifically, reduce the mass loading of contaminants from the source areas into groundwater so that the timeframe to achieve the OU-1 groundwater remedy aquifer restoration goals is facilitated.

The development of OU-2 subsurface PRGs is presented in Sections 5.0 and 6.0. These sections describe how the CTM is used to assess the impact of the source areas on groundwater quality and the timeframe for aquifer restoration. It also presents the methodology for calculating the volume and location of the contaminated material within the source areas that must be addressed to facilitate aquifer restoration. Identification of the subsurface PRGs, or the volume of material to be addressed in the source areas, is presented in Section 6.0.